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ABSTRACT

Present research connected with computer-based instruction indicates that many investigators rely on conventional experimental design and data analysis to address the research question. Although this is appropriate in many cases, the limits of hard and software resources and sample size in other cases have made conventional approaches a poor choice. The special contextual characteristics of computer-based instruction call for a fresh look at the application and research design and data analysis procedures. Therefore, three suggestions are offered and discussed for changing or emphasizing the design of instructional computing research. These suggestions are that: (1) more attention be given to subject/terminal/time ratios; (2) material sampling methods be employed; and (3) site sampling be added as a variable to relevant studies. (JN)

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DISCUSSION OF RESEARCH METHODS AND DESIGNS TO ASSESS THE EFFECTIVESS OF COMPUTER-BASED EDUCATION

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DISCUSSION OF RESEARCH METHODS AND DESIGNS TO ASSESS THE EFFECTIVENESS OF COMPUTER-BASED EDUCATION

INTRODUCTION

The present research connected with computer-based instruction indicates that many investigators rely on conventional expermental design and data analyses to address the research question. In many cases, this is adequate and even desirable because of plentiful resources and subjects. But in many instances, the limits of hard and software resources and sample size have made conventional approaches a poor choice. The special contextual characteristics of computer-based instruction call for a fresh look at the application of research design and data analysis procedures. We need to be more flexable and creative in this area of research. New or different approaches should help to sharpen the research in an area that is receiving high priority on many research agenda.

The purpose of this discussion is to present three suggestions for change or reemphasis in the design of instructional computing research. This suggestions are that: (1) more attention be given to subject/terminal/time ratios; (2) material sampling methods be employed; and, (3) site sampling be added to many studies.

SUBJECT/TERMINAL/TIME RATIOS

As stated above, most of the research on instructional computing has been governed by our reliance on commonly accepted (and expected) experimental design. That is, we strive for large within-cell replication of treatment across numerous subjects. Most of our statistical analyses demand sizable n's. We find ourselves in the position where statistical analysis, which should be the handmaiden of research design, has become the master. This situation is quite intolerable in research regarding computers in learning. It causes us to contrive contextual conditions which are, in the main, probably not the best environment for assessing the effects of the computer-based materials on the individual learner. When the subject sample size is allowed to overly influence the design, we create the situation where the nature of the treatment is also influenced. That is, the treatment becomes spread out across subjects and over time in such a way that effectiveness is undoubtedly diluted. The sample size needs to be a direct function of the subject/terminal/time ratio. For example, if the desired maximum number of individuals who interact with the program is two, then one-hundred terminals would be required to collect data on four-hundred subjects who have one hour of computer-based experience whithin the same daily time frame. This is not a very likely situation in most research or instructional settings. Even if the number of subjects is quartered, twenty-five terminals would need to be dedicated

to the research efforts. This is a more likely available number but still not a common situation. Where possible, these kinds of resources need to be employed in instructional computing research to serve conventional research designs which require large n's with low subject/terminal/time ratios.

Other approaches are needed where the optimum S/T/T ratios are maintained but the number of terminals is limited. We need to revive and recognize the legitimacy of low n and case study research.

A major deterrent to the use of these designs in the past has been that intensive, extensive, and many times, complex data collection is required. But, now the computer itself can tend to a large portion of this arduous task. Just as the computer program patiently receives, responds, and tutors, it can record the nature, order, and timeliness of the learner's interactions much more diligently, unobtrusively, and perhaps more objectively than the researcher. This is the only way that we are going to discover the nature of the pupil/computer interface and understand its influence on learning.

THE NEED FOR MATERIALS SAMPLING

Much of the research on computer assisted instruction has been carried out on a limited presentation of materials

which have been influenced more by coding skills, graphics capabilities (or incapabilities) and hardware designs than by curriculum and learning theory. Therefore, the generalizability of findings to the genera of computer based materials is quite limited.

The use of research designs and data analyses where the specific materials used are random factors under fixed treatments is called for. For example, one should not be sastisfied with a conclusion that computed based laboratory simulations have "X" level of effect on the basis of a single set of materials (say batteries and bulbs). At least three sets of simulations (say batteries and bulbs, titrations and rolling cylinders) should be presented and treated as a seperate random variable under the computer based simulations treatment which is fixed.

Materials sampling procedures have been used very little in educational research. But, because of the great variations in the type and quality of computer based instructional materials, it is essential that this approach be employed in instructional computing researach. To do less saddles us with an intolerable restriction on the generalizability of the research findings. Findings which are essential to development and implementation of the most powerful teaching/learning technology since the textbook.

THE NEED FOR SITE SAMPLING

Presently the use of computers in instruction and research thereon has been largely constrained by the accepted and widespread belief that the conventional classroom is the fertile nest of instruction and learning. One can be convinced that the acquisition of concepts and skills is a natural phenomna. But, it is a little harder to agree that the contemporary classroom is the most natural setting conducive to this acquisition.

Much more work needs to be carried out where the research design accounts for the site as a variable and the research samples learning sites of both formal (i.g. shcools) and informal (i.g. museums, homes) types. The site variable should be analyzed as a fixed factor and inspected for statistical interactions with all other factors in the design. The touted power of the computer as a readily available, individualized, self-paced, diagnosing/prescribing and personal learning device can be adequately research in no other way.